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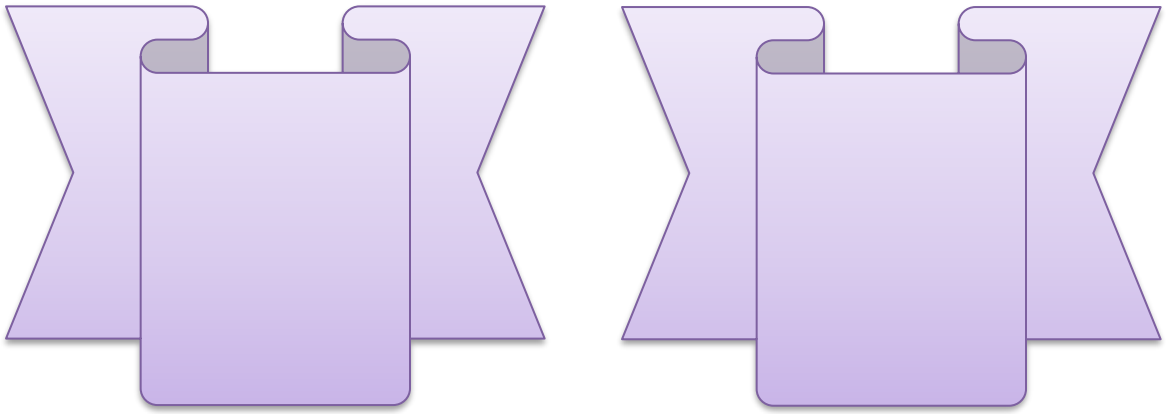

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## Original Article

# Comparison of Ultrasound-Guided Rectus Sheath Block Versus Local Infiltration at The Port Sites and Intraperitoneal Instillation of 0.25% Bupivacaine for Post-Operative Pain Control After Laparoscopic Cholecystectomy

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## ABSTRACT

**Background:** Despite laparoscopic cholecystectomy being less invasive, patients report significant pain within the first 24 h following surgery. To minimize post-operative pain, a number of preoperative, intraoperative, and postoperative pain management techniques are available. These include low-pressure pneumoperitoneum, use of opioids, local anesthetic infiltration, intraperitoneal instillation, thoracic paravertebral or epidural blocks, and intraperitoneal infiltration of local anesthesia.

**Aim of the work:** This research aimed to evaluate rectus sheath block versus local infiltration with regard to efficacy at the port sites with an intraperitoneal injection of bupivacaine for pain control following a laparoscopic cholecystectomy.

**Patients and Methods:** This prospective comparison research involved 80 patients including both genders who were set for laparoscopic cholecystectomy. Two groups of patients were determined: Group I: Received 30 ml of 0.25 % bupivacaine 15 ml for intraperitoneal instillation and 15 ml for local infiltration at the port sites. Group R: Bupivacaine 0.25% in 30 ml was administered bilaterally [RSB] [15 ml on each side].

**Results:** Regarding postoperative [VAS], there was statistically significant variation among the two groups at 16 and 24 hours postoperatively [p= 0.013]. As for postoperative request analgesia, the intraperitoneal instillation group [11.8 ± 0.34 hour] and the RSB group [17.16 ±4.83 hour] as needed their first dose of rescue analgesic. Statistical analysis revealed clear group distinction [p = 0.002]. Regarding patient satisfaction. No significant variations were observed between the groups.

**Conclusion:** Bupivacaine intraperitoneal infused with local infiltration at the port sites an effective analgesic approach, as is ultrasound-guided rectus sheath block, but [RSB] was better due to longer postoperative pain relief and less opioid consumption. Both methods are easy, risk-free, and without adverse effects.

**Keywords:** Rectus sheath block; Intraperitoneal instillation; Local infiltration; Bupivacaine; Laparoscopic cholecystectomy.

## INTRODUCTION

Conditions like cholecystitis and cholelithiasis that persist over time are extremely common. The prevalence of gallstone disorders varies greatly according to factors such as location and, most importantly, ethnicity. A higher risk of dying from all causes, heart disease, and cancer has been linked to gallstone disease in recent research [1]. Symptoms of gallbladder inflammation include Murphy's sign positivity, upper right abdominal pain and tenderness, and a high temperature. Stones in the gallbladder, bacterial and fungal infections, altered gallbladder hemodynamics, and other variables all contribute to the development of gallstone disease. According to recent studies, chronic cholecystitis has an intrinsic mechanism that is linked to bile duct motility abnormalities and lipid metabolism problems [2].

Acute postoperative pain is a common complication of surgery, yet statistics show that only around half of those in pain receive effective pain treatment. The new clinical practice guidelines strongly advise employing multimodal analgesia, which employs a number of drugs and procedures to maximize the effectiveness and alleviate pain more effectively than single-modality therapies [3].

A minimally invasive procedure frequently carried out in daycare facilities is laparoscopic cholecystectomy. During and after laparoscopic cholecystectomy, Incisions in the anterior abdominal wall are a major source of pain because they are innervated by nociceptor afferents from the fascial plane separating the internal oblique and transversus abdominis muscles [4].

Despite the laparoscopic cholecystectomy being less invasive, patients report significant pain during the initial 24 hours after surgery. To minimize post-operative pain, there are a number of preoperative, intraoperative, and postoperative pain management techniques. These include low-pressure pneumoperitoneum, nonsteroidal anti-inflammatory drugs, the use of opioids, local anesthetic infiltration, intraperitoneal instillation, epidural blocks, or thoracic paravertebral and rectus sheath blocks. However, each modality has its own set of restrictions [5].

Local anesthetics reversibly stop the formation and spread of action potentials in nerve and other excitable tissues, most likely at the passive sodium channel level. The local anesthetic bupivacaine is frequently employed. It is a powerful agent that may produce long-lasting anesthesia and because of its propensity to produce more sensory than motor block, it is a common medication for supplying prolonged analgesia during the postoperative period [6].

The rectus sheath block is a traditional localized anesthetic procedure, but with the introduction of long-acting local anesthetics and small, portable ultrasonography equipment, it has recurred as a cutting-edge analgesic method for the treatment of postoperative pain [7].

The procedure seeks to block the T7–T12 intercostal nerves' ventral rami, which innervate the rectus abdominis muscles and the skin above them. A local anesthetic is injected into the area that separates the rectus muscle from the posterior rectus sheath to produce a compartmental block. A catheter can be placed here to administer local anesthetics in the form of periodic boluses or continuous infusions to maintain the block's effectiveness [8].

Local anesthetics have been administered at port sites for somatic pain relief and injected in the peritoneum for visceral pain relief. Bupivacaine injections at the locations of laparoscopic incisions appear to lessen discomfort after surgery. Additionally, when injected directly into the peritoneal cavity, bupivacaine has been demonstrated to safely reduce postoperative pain [9].

## THE AIM OF THE WORK

The purpose of this study is to compare local infiltration with rectus sheath block in terms of efficacy at the port sites with an intraperitoneal injection of 0.25% bupivacaine as a means of controlling discomfort after a laparoscopic cholecystectomy.

**The primary outcome:** is postoperative pain score [VAS].

**Secondary outcomes:** Patient satisfaction and postoperative opioid consumption.

## PATIENTS AND METHODS

In this prospective comparative study, 80 patients aged 30:60 years old of both sexes, ASA [I or II], and failure of medical treatment

scheduled for laparoscopic cholecystectomy in Alhussin and Alzharaa hospitals between June 2022 to March 2023 participated [Figure 1]. The systematic random approach was used to acquire samples. Obtaining written informed permission and approval from a local ethics commission are prerequisites for conducting the study [IRB 000310-2022] of Cairo, Faculty of Medicine, Al-Azhar University. Two groups of patients were present**:**

**Group I [40 cases]:** Received 30 milliliters of bupivacaine 0.25% which divided in to 15 ml intraperitoneal instillation and 15 ml local infiltration at the port sites.

**Group R [40 cases]:** 30-milliliter bupivacaine RSBs were administered bilaterally [15 ml at both ends].

**Study design:** a prospective, single-blind, randomized study.

**Exclusion criteria:**

- Individuals that are allergic to local anesthetics.
- Patient refusal.
- Abnormal coagulation status.
- Serious systemic disease.
- Pregnancy.

**Methods**

Informed consent was taken from every patient. medical, surgical, and family history, complete physical examination, and laboratory investigations were done. General checkup for indicators of life's vitality [Blood pressure, temperature, respiratory rate, and heart rate].

All patients were undergoing laparoscopic cholecystectomy under general anesthesia. On arrival of the patient at the operative room, basic monitoring [NIBP, ECG, SpO2] is applied and an 18-gauge peripheral IV line will be secured.

Anesthesia was induced after pre-oxygenation by fentanyl 2 mic/kg, propofol 2 mg/kg, and atracurium 0.5 mg/kg followed by endotracheal intubation. Atracurium 0.1 mg/kg when needed and isoflurane 1.2% used to maintain anesthesia.

**In group [I]:** Following completion of the operation and under direct laparoscopic control, the patients were placed in the 20-degree Trendelenburg position. The gall bladder bed was injected with 15 ml of 0.25% bupivacaine. All patients were held in a 15-20° Trendelenburg position for around 2 minutes following local anesthetic injection and local infiltration of 15 ml 0.25 % bupivacaine on trocar sites. Camera port [umbilical port] and working port [epigastric port] were injected of local infiltration because larger in size about 12 mm. Lateral port no injection due to the small size about 5 mm [figure 2].

**In group [R]:** After the end of the surgery, a rectus sheath block was given on both sides following induction. Linea alba was seen in the upper abdomen while using an aseptic approach and direct ultrasonic guidance with a sheathed linear transducer probe [high-frequency sonosite M Turbo Fujifilm sonosite USA]. In order to see the rectus muscle's actual anatomy, we had to slide the probe to the side. Behind the rectus muscle are a series of "tramlines" formed by the transversalis fascia and the posterior rectus sheath. The tip of a 16 G needle was inserted using an in-plane approach until it was situated anterior to the "tramlines" but posterior to the rectus muscle. When the needle's tip reaches the back sheath, the procedure is considered successful [tramlines]. Local anesthetics were delivered after a bolus of normal saline was introduced to hydro-dissect the planes [figure 3].

**The assessment includes**

1. Patient demographic data.

2. The VAS was employed for the purpose of the severity of postoperative pain [VAS] pain score [range, 0–10; 0, no pain; 10, worst pain] at 1, 2, 4, 8, 16, and 24 hours. Patients with VAS of more than 3, received titration of 2 mg intravenous morphine every 10 min until VAS became equal or less than

3. Post-operative morphine consumption and the postoperative first call for rescue analgesia were recorded.

4. A three-point scale was used to evaluate the level of patient satisfaction [1, excellent; 2, good; 3, poor].

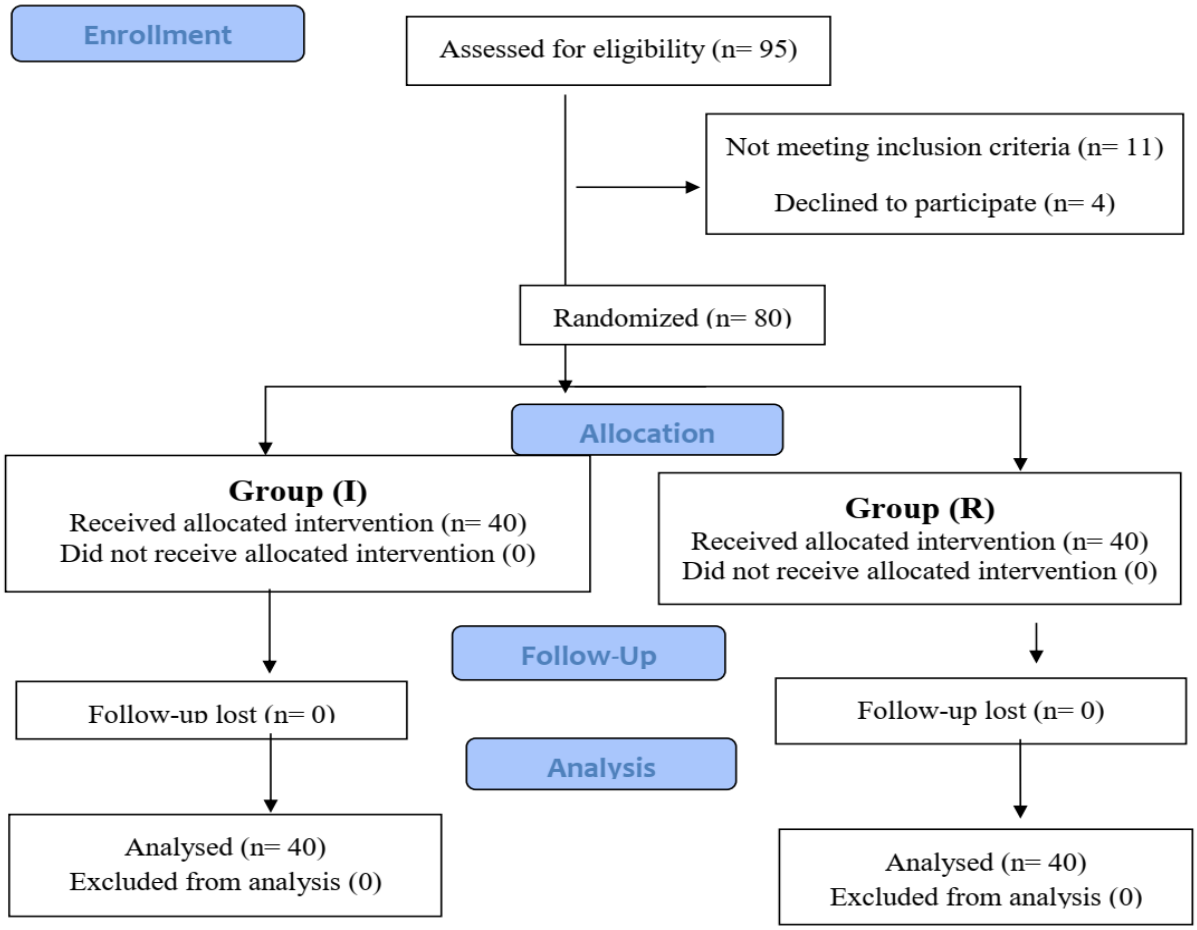


**Figure [1]: CONSORT Flow Diagram**

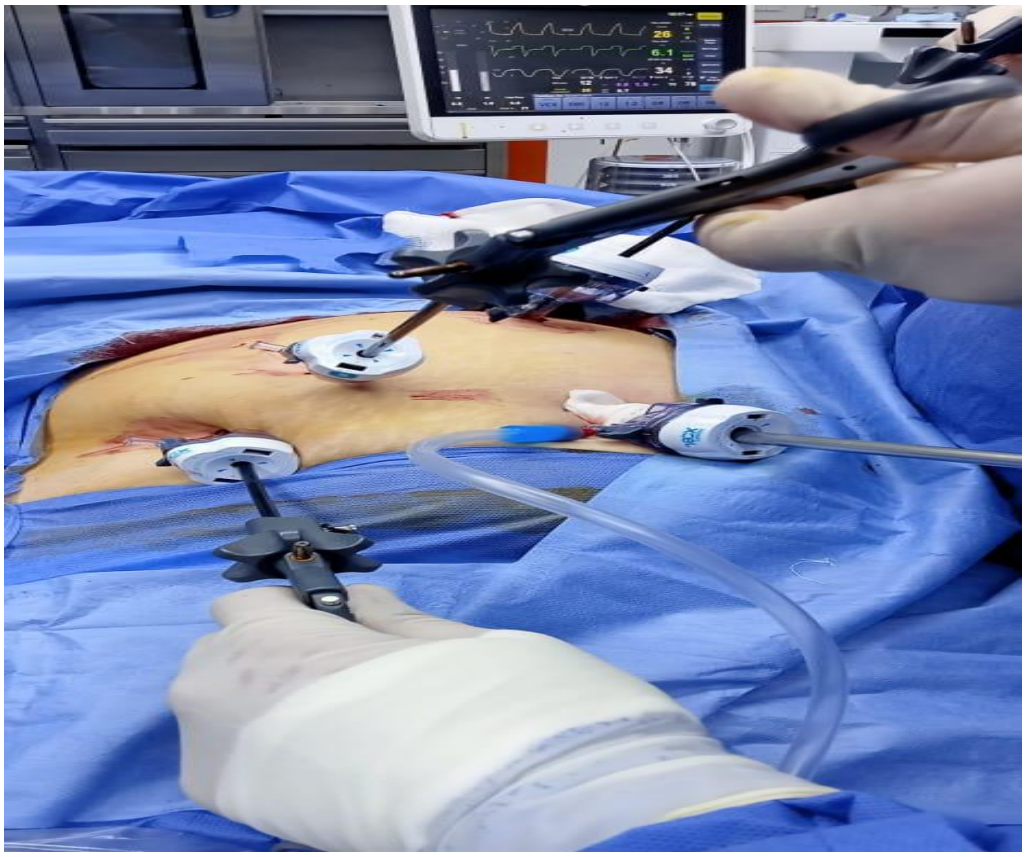

**Figure [2]:** Intraperitoneal instillation in group [I]

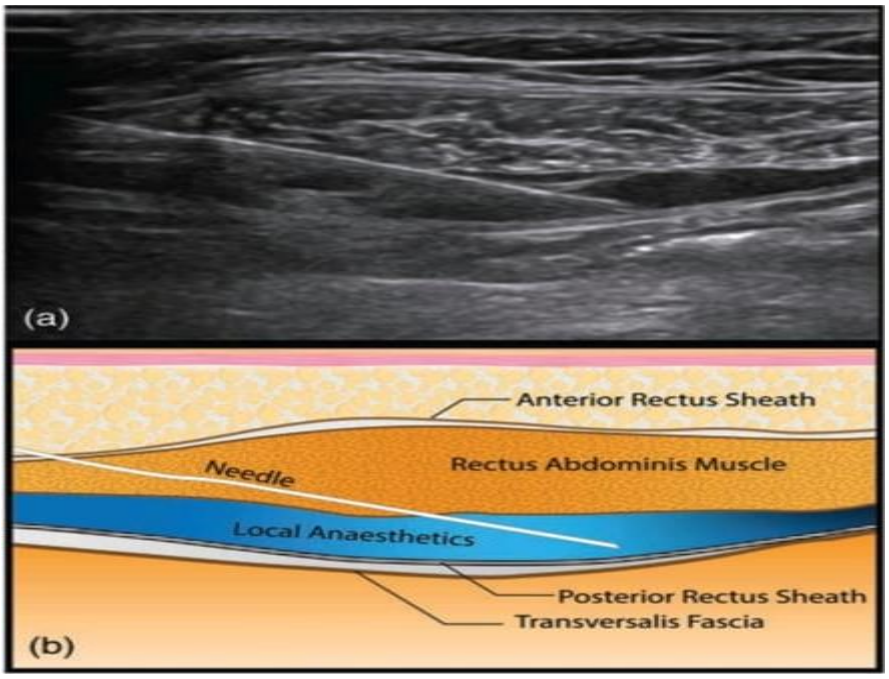


**Figure [3]:** [a]: U/S image of RSB; [b]: Schematic diagram of U/S guided RSB

**Randomization and blinding:** A computer software application generated used in a randomization that distributed 80 patients equally among the two groups that were kept secret inside sealed envelopes.

**Sample size justification:** Calculations with a statistical tool Med Calc® version 12.3.0 designed Ostend, Belgium by the Epi Info mobile application [epi info TM] yielded the finalized sample size. 80.0 % was chosen as the study's power, 95% as its confidence level, and 1.0 as the ratio of controls to cases. According information from Abdelaziz and **Abd Elghany** study [10], the duration of postoperative analgesia was used to calculate the sample size. According to the formula, at least 40 patients were needed in each group to detect a significant variation at α value of 0.05 and power of study 80 %. So, we will include a total of 80 participants.

**Data analysis:** SPSS was used for both data entry and analysis [SPSS 20.0 Version]. Calculations of mean, proportion, and percentage will be made. In order to determine any kind of correlation, a Chi-square test will be used. The two groups were contrasted using an independent t-test. The Fishers Exact Examine and the chi-square analysis were used to test for group differences. If the probability level was lower than 0.05, the result was deemed significant; otherwise, it was deemed non-significant.

## RESULTS

80 patients of both sexes, ASA [I and II] scheduled for laparoscopic cholecystectomy. Two groups of patients were present: Group I [40 patients]: Received 30 ml of 0.25 % bupivacaine 15 ml intraperitoneal instillation and 15 ml local infiltration at port sites. Group R [40 patients]: Received bilateral RSB with 30 ml of 0.25 % bupivacaine [15 ml on each side].

Basic data: There were statistically insignificant variation between both groups in terms of age, sex, ASA, and the length of operation [Table: 1].

Postoperative pain by [VAS] pain score which still below < 4 throughout the study indicate good pain control in both groups. At 2, 4, 8 hour postoperatively mean VAS score equal in both groups. At 16, 24 hours postoperatively mean VAS score were high in group I than group R as shown in table [2].

Regarding total postoperative morphine consumption, there were increases of morphine consumption in group I than group R. First postoperative request for rescue analgesia was shown in table [3].

Regarding patient satisfaction score, there were equal satisfaction score between two groups as shown in table [4].

**Table [1]:** Basic data of study population

| Parameter | Group [I] [n =40] | Group [R] [n =40] | P-value |
|---|---|---|---|
| **Age [mean ± SD]** | 38.05 ± 1.91 | 42.25 ± 2.62 | 0.57 |
| **Sex [Male: Female]** | 22 :18 | 25 :15 | 0.43 |
| **ASA [I:II]** | 16: 24 | 19: 21 | 0.65 |
| **Duration of operation** | 54.31 ± 2.51 | 49.21 ± 6.25 | 0.74 |

**Table [2]:** Postoperative pain was assessed by the visual analog scale [VAS] pain score

| Parameter | Group [I] [n =40] | Group [R] [n =40] | P-value |
|---|---|---|---|
| **2 hours** | 0 [0-1] | 0 [0-1] | 0.78 |
| **4 hours** | 1 [0-1] | 0 [0-1] | 0.78 |
| **6 hours** | 1 [1-2] | 1 [1-2] | 0.60 |
| **8 hours** | 2 [1-2] | 1 [1-2] | 0.57 |
| **10 hours** | 3 [2-3] | 2 [1-2] | 0.05 |
| **16 hours** | 4 [2-4] | 2 [1-2] | **0.002** |
| **18 hours** | 4 [3-4] | 3 [2-3] | **0.001** |
| **20 hours** | 5 [3-5] | 3 [2-3] | **0.003** |
| **24 hours** | 6 [4-6] | 4 [3-4] | **0.013** |

**Table [3]:** Postoperative first call for rescue analgesia and total post-operative morphine consumption

| Parameter | Group [I] [n =40] | Group [R] [n =40] | P-value |
|---|---|---|---|
| **Postoperative first call for rescue analgesia [h]** | 11.8 ± 0.34 | 17.16 ±4.83 | **0.002** |
| **Total post-operative morphine consumption [mg]** | 8.98 ± 0.58 | 6.21 ± 0.65 | **0.001** |

**Table [4]:** Comparison of the two groups' patient satisfaction ratings

| Parameter | Group [I] [n=40] | Group [R] [n=40] |
|---|---|---|
| **1** | 18 [4.5 %] | 23 [57.5 %] |
| **2** | 24 [60 %] | 14 [35 %] |
| **3** | 8 [20 %] | 3 [7.5 %] |
| **P- value** | 0.087 | |

## DISCUSSION

Bilateral RSB is used to reduce postoperative pain after laparoscopic, pediatric, gynecological, and umbilical hernia surgery. It gives better analgesia over the core portion of the ventral abdominal wall from the xiphisternum to the symphysis pubis [11].

There were differences in age, sex, and weight across the groups, but they were not statistically significant. This agrees with the findings of two studies [1, 12], who found no statistically significant variations in HR or MAP between the groups throughout any time point from baseline [T1] to terminal [T5].

In this study, we found that fentanyl consumption was significantly higher in the intraperitoneal instillation group compared to the rectus sheath group, and that there was also a statistically significant rise in MAC in the intraperitoneal instillation group.

In the current study, the intraperitoneal instillation group [11.8 ± 0.34 hour] and the RSB group [17.16 ±4.83 hour] as needed their first dose of rescue analgesic. The rectus sheath block group had a significantly longer mean survival time. Significant differentiation was observed between the rectus sheath group and the intraperitoneal instillation group. **Gupta *et al.*** [12] study found that The RSB group had a much longer delay to first rescue analgesia [16.16±4.73 h] and intraperitoneal instillation group [7.84±1.34 h] as compared to the control group [1.72±0.67 h].

**Choi *et al.*** [15] reported that in single port laparoscopic hysterectomy, rectus sheath block is performed as part of a multimodal strategy for pain management.

Researchers showed that at 30, 60, 90, 2 hours, 4 hours, 6 hours, 12 hours, 18 hours, and 24 hours following surgery, the VAS scores in the rectus sheath block group were lesser than in the control group. These findings are agreed with **Laguduva *et al.*** study [14] on Patients having laparotomy surgery benefit more from rest and cough analgesia after bilateral ultrasound-guided RSB than they would after LA infiltration. With RSB, patients used less morphine, had fewer episodes of postoperative

nausea and vomiting, and waited longer before asking for pain medication.

Consistent with the findings of **Metwally *et al*.** [13], we found no substantial variation across research groups between the hours of 6-8 and 10-12 postoperatively, but they did find a big distinction between the groups from 18 to 24. **Gupta *et al*.** [12] found that patients who underwent laparoscopic cholecystectomy and received either a rectus sheath block or intraperitoneal instillation of 0.25% ropivacaine had significantly better postoperative analgesia compared to the control group.

In the current study, we found 23 [57.5 %] excellent patient satisfaction scores in rectus sheath block but 18 [4.5 %] excellent patient satisfaction scores in intraperitoneal instillation.

**Conclusion:** Bupivacaine intraperitoneal infused with local infiltration at the port sites an effective analgesic approach, as is ultrasound-guided rectus sheath block, but [RSB] was better due to longer postoperative pain relief and less opioid consumption. Both methods are easy, risk-free, and without adverse effects.

**Limitations:** There were multifactorial of patients' satisfaction and short time of postoperative follow up.

**Financial support and sponsorship:** Nil.

**Conflicts of interest**: Nil.

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